

### **REMARKS/ARGUMENTS**

Reconsideration of this application in light of the above amendments is courteously solicited.

Applicant submits in the instant preliminary amendment new independent claim 33. New independent claim 33 positively recites the process step of sintering a further piece of the porous ceramic material under a set of sintering conditions to determine an achievable relative density of the material after sintering. This new claim has been submitted in response to the Examiner's previously raised rejection under 35 U.S.C. 112, first paragraph. Clearly it is within the realm of the skilled artisan to preprocess under the desired sintering conditions a piece of the porous ceramic material in order to determine what the achievable relative density of that material would be. Independent claim 33 sets forth the sintering step. It is respectfully submitted that claim 33 and the claims which depend therefrom comply with the requirements of 35 U.S.C. 112, both first and second paragraphs and are in condition for allowance.

With regard to previously submitted independent claim 16, it is respectfully submitted that claim 16 complies with 35 U.S.C. 112, first paragraph. It is difficult to imagine that the Examiner cannot agree that it is within the realm of the skilled article to preprocess a piece of the porous ceramic material under desired sintering conditions in order to determine the achievable relative density prior to carrying out subsequent steps of determining the enlargement factor, scanning and digitizing, enlarging the obtained data, transferring the modified data, etc. If the Examiner is to hold otherwise, it would be appreciated for the Examiner to give detail why he believes that such is not the case. In light of the foregoing comments, it is submitted that claim 16 and the claims which depend therefrom comply with 35 U.S.C. 112, first paragraph.

An early action on the merits is respectfully requested.

An earnest and thorough attempt has been made by the undersigned to resolve the outstanding issues in this case and place same in condition for allowance. If the Examiner has any questions or feels that a telephone or personal interview would be helpful in resolving any outstanding issues which remain in this application after consideration of this amendment, the Examiner is courteously invited to telephone the undersigned and the same would be gratefully appreciated.

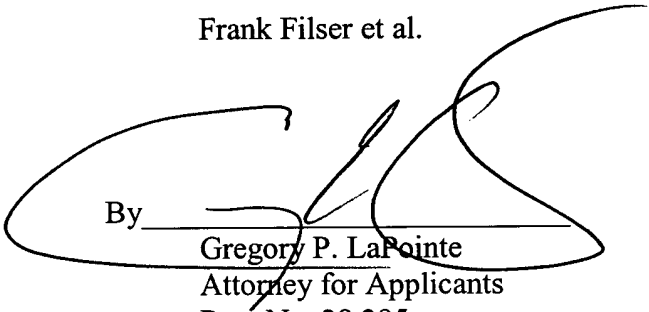
It is submitted that the claims as amended herein patentably define over the art relied on by the Examiner and early allowance of same is courteously solicited.

If any fees are required in connection with this case, it is respectfully requested that they be charged to Deposit Account No. 02-0184.

Respectfully submitted,

Frank Filser et al.

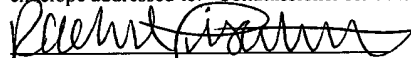
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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313" on October 10, 2003.



Rachel Piscitelli

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

Claims 1-15 (cancelled):

Claim 16 (currently amended): A process for production of an artificial tooth substitute to be fitted on a prepared dental stump comprising the steps of:

selecting a preprepared blank of porous ceramic material having a relative density  $\rho_R$  and an achievable relative density  $\rho_S$  after sintering;

scanning and digitizing a three-dimensional outer and inner surface of a positive model of a skeletal structure for the artificial tooth substitute to obtain data;

determining an enlargement factor (f) for the obtained data in accordance with the following

$$f = \sqrt[3]{\frac{\rho_S}{\rho_R}}$$

where  $\rho_R$  is the relative density of the preprepared blank and  $\rho_S$  is the achievable relative density after ~~dense-sintering~~ sintering;

enlarging the obtained data linearly in all directions by the enlargement factor (f) thereby compensating precisely for sinter shrinkage to obtain modified data for an enlarged model;

transferring the modified data to a control unit of a processing machine;

processing the blank of the preprepared porous ceramic material in the processing machine and removing material therefrom to produce a design form of the enlarged model;

~~dense-sintering~~ sintering the design form of porous ceramic material to obtain a skeletal

structure having precise end dimensions; and

facing the skeletal structure as desired to form the artificial tooth substitute.

Claim 17 (currently amended): A process according to claim 16 or 33, wherein the artificial tooth substitute is formed with fine run-out margins.

Claim 18 (currently amended): A process according to claim 16 or 33, wherein the machined enlarged model is sintered to a density  $P_S$  of 90 to 100% of the theoretically possible density.

Claim 19 (currently amended): A process according to claim 16 or 33, wherein the machined enlarged model is sintered to a density  $P_S$  of 96 to 100% of the theoretically possible density.

Claim 20 (currently amended): A process according to claim 16 or 33, wherein the machined enlarged model is sintered to a density  $P_S$  of greater than 99% of the theoretically possible density.

Claim 21 (currently amended): A process according to claim 16 or 33, wherein the blank is a presintered blank of pressed fine ceramic powder.

Claim 22 (currently amended): A process according to claim 16 or 33, including processing the blank in a first rough machining and then a second final machining.

Claim 23 (currently amended): A process according to claim 16 or 33, wherein the blank is heat treated at temperatures in the range from 50 to 200°C for a duration of 2 to 20 hours.

Claim 24 (currently amended): A process according to claim 16 or 33, wherein the blank is heat treated at temperatures in the range from 90 to 150°C for a duration of 2 to 6 hours.

Claim 25 (previously presented): A process according to claim 23, wherein processing of the blank into the enlarged model follows the heat treatment.

Claim 26 (previously presented): A process according to claim 24, wherein processing of the blank into the enlarged model follows the heat treatment.

Claim 27 (previously presented): A process according to claim 21, wherein the presintered blank undergoes presintering for 0.5 to 6 hours at a temperature of at least 450°C.

Claim 28 (currently amended): A process according to claim 16 or 33, wherein the blank is formed of a material selected from the group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{TiO}_2$ ,  $\text{MgO}$ ,  $\text{Y}_2\text{O}_3$ , zircon oxide mixed crystal  $\text{Zr}_{1-x}\text{Me}_x\text{O}_2-(4n/2)_x$ , and mixture thereof, where Me is a metal which is present in the oxide form as a bi-, tri-, or tetravalent cation ( $n = 2, 3, 4$  and  $0 \leq x \leq 1$ ) and stabilises the tetragonal and/or cubic phase of the zircon oxide.

Claim 29 (previously presented): A process according to claim 28, wherein the material is mixed with an organic bonding agent selected from the group consisting of polyvinyl alcohols (PVA), polyacrylic acids (PAA), celluloses, polyethyleneglucols, thermoplastics and mixtures thereof.

Claim 30 (previously presented): A process according to claim 29, wherein the proportion of binding agent lies in the range from 0.1 to 45 vol%.

Claim 31 (previously presented): A process according to claim 29, wherein the proportion of binding agent lies in the range from 0.1 to 5 vol%.

Claim 32 (previously presented): A process for production of an artificial tooth substitute to be fitted on a prepared dental stump comprising the steps of:

scanning and digitizing a three-dimensional outer and inner surface of a positive model of a skeletal structure for the artificial tooth substitute to obtain data;

determining an enlargement factor (f) for the obtained data in accordance with the following

$$f = \sqrt[3]{\frac{\rho_S}{\rho_R}}$$

where  $\rho_R$  is the relative density of a preprepared blank and  $\rho_S$  is the achievable relative density after sintering;

enlarging the obtained data linearly in all directions by the enlargement factor (f) thereby compensating precisely for sinter shrinkage to obtain modified data for an enlarged model;

transferring the modified data to a control unit of a processing machine for generating a desired path of a tool;

ceasing scanning and digitizing;

processing a blank of porous ceramic material in the processing machine wherein material is removed by the tool moving along the devised path to produce a design form of the enlarged model;

dense-sintering the design form of porous ceramic material to obtain a skeletal structure having precise end dimensions; and

facing the skeletal structure as desired to form the artificial tooth substitute.

Claim 33 (new): A process for production of an artificial tooth substitute to be fitted on a prepared dental stump comprising the steps of:

- (a) selecting a preprepared blank of porous ceramic material having a relative density  $\rho_R$ ;
- (b) sintering a further piece of the porous ceramic material under a set of sintering conditions to obtain an achievable relative density  $\rho_S$  of the ceramic material after sintering;
- (c) determining an enlargement factor (f) for the obtained data in accordance with the following

$$f = \sqrt[3]{\frac{\rho_S}{\rho_R}}$$

where  $\rho_R$  is the relative density of the preprepared blank and  $\rho_S$  is the achievable relative density of the porous ceramic material after sintering obtained in step (b);

- (d) scanning and digitizing a three-dimensional outer and inner surface of a positive model of a skeletal structure for the artificial tooth substitute to obtain data;
- (e) enlarging the obtained data linearly in all directions by the enlargement factor (f) thereby compensating precisely for sinter shrinkage to obtain modified data for an enlarged model;

- (f) transferring the modified data to a control unit of a processing machine;
- (g) processing the blank of the preprepared porous ceramic material in the processing machine and removing material therefrom to produce a design form of the enlarged model;
- (h) sintering under the set of sintering conditions of step (b) the design form of porous ceramic material to obtain a skeletal structure having precise end dimensions; and
- (i) facing the skeletal structure as desired to form the artificial l tooth substitute.